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US 4828523 A US 4806820 A

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(54) **Colour selecting mechanism for a cathode-ray tube**

(57) A method of assembling a colour selecting mechanism for a cathode-ray tube includes the steps of: preparing a grid structure 1 having a plurality of slits 3; applying pressure to a frame 7 having a pair of members 9 in parallel to each other in such a manner that the members 9 are moved towards each other; welding a pair of opposite sides of the grid structure 1 to the members 9; and releasing the pressure applied to the frame 7 to leave the grid structure 1 in a tensioned state; wherein each of intervals "w" between points at which the grid stricture 1 is welded to the members 9 is set to be in a range from 20 to 35 times a thickness "t" of the grid structure 1 and from 8 to 14 times a pitch "p" of the slits 3.

FIG. 1

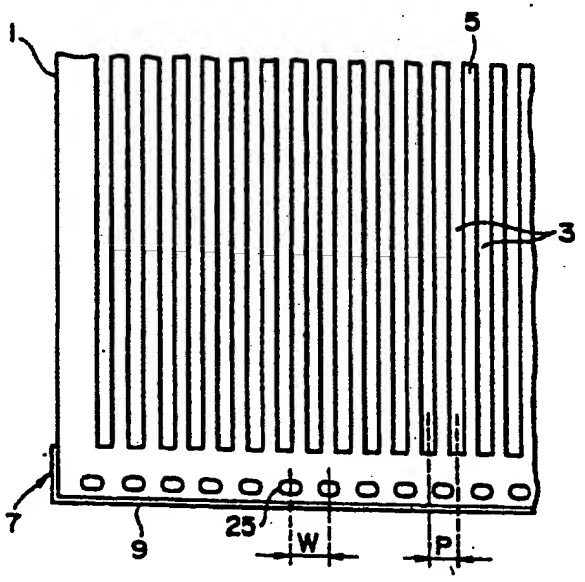

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FIG. 1

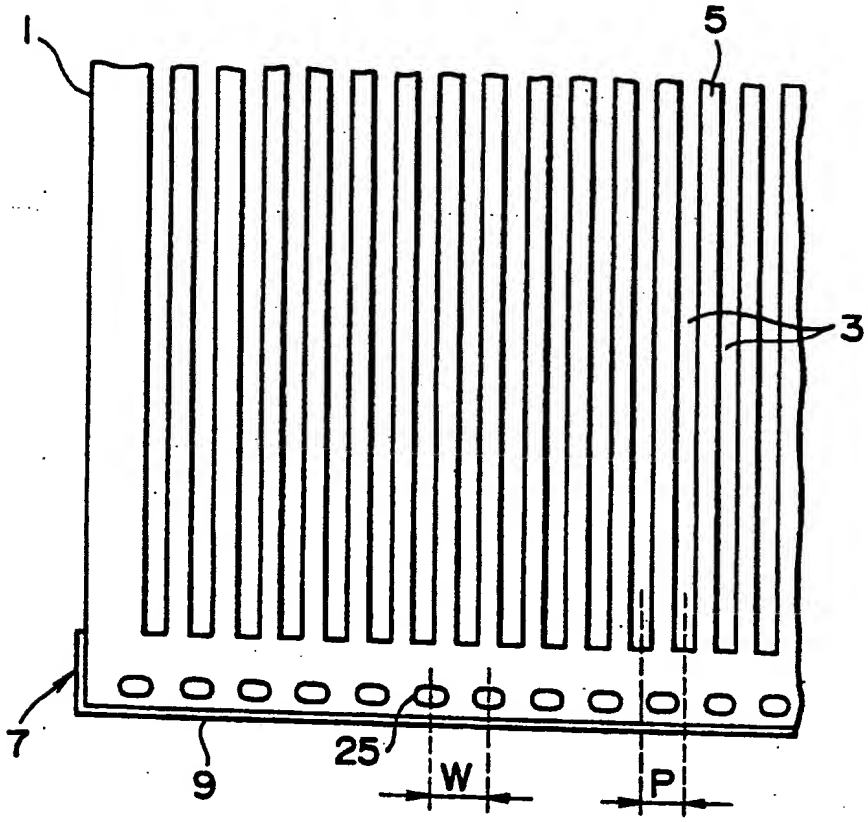


FIG. 2

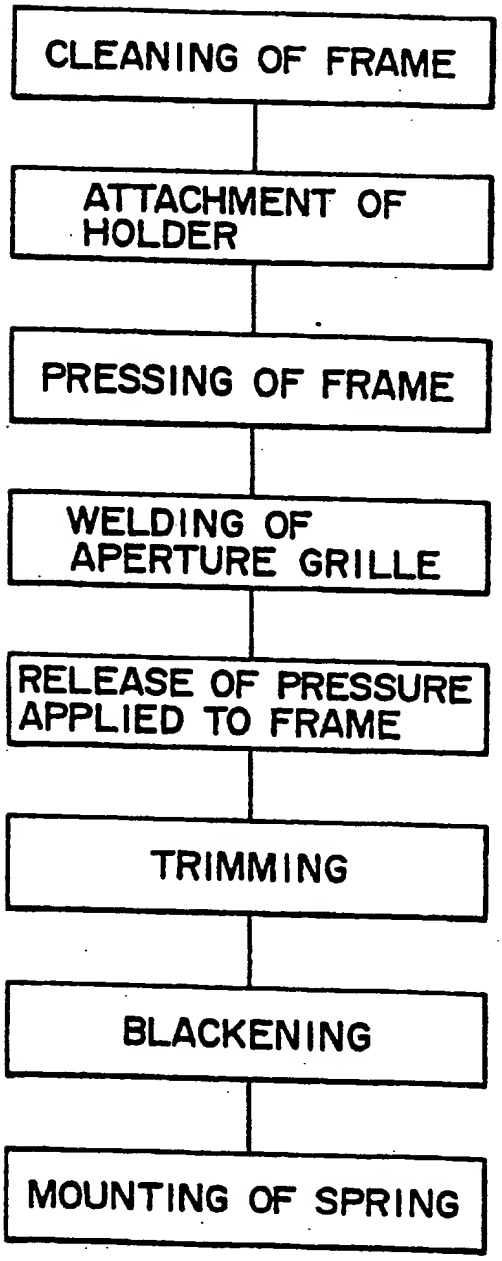

CLEANING OF FRAME
ATTACHMENT OF HOLDER
PRESSING OF FRAME
WELDING OF APERTURE GRILLE
RELEASE OF PRESSURE APPLIED TO FRAME
TRIMMING
BLACKENING
MOUNTING OF SPRING

FIG. 3

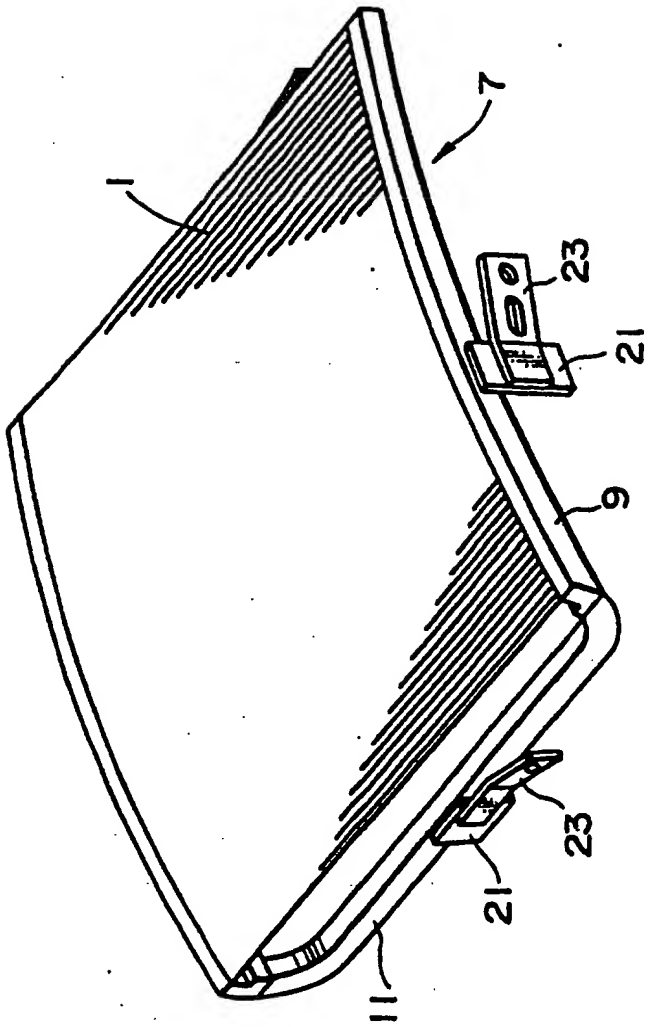
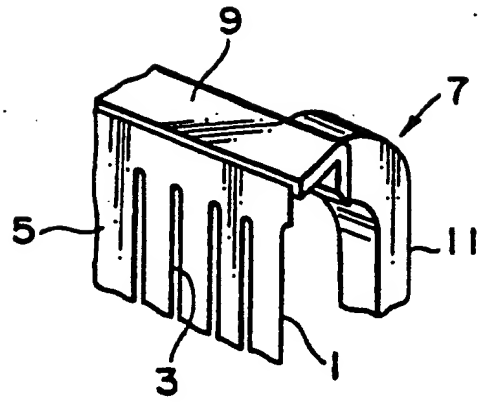


FIG. 4



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METHOD OF ASSEMBLING COLOUR SELECTING MECHANISM FOR CATHODE-RAY TUBE AND COLOUR SELECTING MECHANISM ASSEMBLED BY THE METHOD

The present invention relates to a method of assembling a colour selecting mechanism for a colour cathode-ray tube, and to a colour selecting mechanism assembled by the method.

Colour selecting mechanisms for colour cathode-ray tubes have been known, of a type in which a grid structure formed of a metal sheet having a plurality of slits (beam apertures) is mounted on a metal frame. A trinitron (trade name) type cathode-ray tube adopts a grid structure having linear apertures, which is called an aperture grille.

Figure 3 of the accompanying drawings is a perspective view of a colour selecting mechanism, and Figure 4 is an enlarged view of an essential portion of an aperture grille. An aperture grille 1 formed of a rectangular metal sheet has in an effective screen a plurality of slits 3 for allowing an electron beam to pass therethrough and tape portions 5 between these slits 3. The aperture grille 1 is mounted on a metal frame 7 formed in a rectangular shape by welding. The frame 7 includes a pair of parallel A members 9 which are curved and to which the aperture grille 1 is to be welded, and B members 11 each connecting both ends of each of the A members 9 to each other.

The aperture grille 1 is mounted on the frame 7 by the steps of pressing the frame 7 in the direction where the A members 9 are close to each other, and welding in such a state opposed sides of the aperture grille 1 each to the A members 9 at suitable intervals between welded points by seam welding or laser welding.

Next, by releasing the pressure applied to the frame 7, the aperture grille 1 is mounted on the frame 7 in a state of being stretched at a high tension. The reason why the aperture grille 1 is mount d in a stretched state is to reduce mislanding of electron beams passing through slits of the aperture grille 1 on a phosphor screen due to thermal

expansion of the aperture grille 1 upon operation of the cathode-ray tube. An xcess peripheral portion of the aperture grille 1 proj cting from the frame 7 is removed by trimming, thus completing the mounting of the aperture grille 1 on the frame 7.

Recently, in colour selecting mechanisms with the trend toward high precision and light weight, it has been required to make the slit pitch finer and to make the aperture grille 1 thinner. This makes it difficult to mount the aperture grille 1 on the frame 7 in such a manner as to prevent occurrence of wrinkles by keeping the tape portions 5 in a suitable state, that is, in a state matched with the curved surfaces of the A members 9. For example, with respect to an aperture grille 1 having a thickness of 0.1 mm, when the pressure applied to the frame 7 is released, wrinkles do not occur if the slit pitch is set at 0.5 mm; however, they occur at a high occurrence rate if the slit pitch is set at 0.25 mm. The occurrence rate of wrinkles is also dependent on the thickness of the aperture grille 1, and more concretely, it tends to be increased as the thickness of the aperture grille 1 becomes thinner.

The intervals between welded points at which the opposed sides of the aperture grille 1 are welded to a pair of the parallel A members 9 by seam welding or laser welding, have been suitably set to prevent occurrence of wrinkles. In the aperture grille 1, when each interval between welded points is excessively widened, a stress is concentrated at each welded point due to a reaction force from the frame 7 from which the compression is released, tending to produce torsion and strain at each tape portion 5. On the other hand, when the interval between welded points is excessively narrowed, each tape portion 5 cannot absorb a difference in stress between adjacent welded points and thereby it tends to receive torsion and strain.

Accordingly, the related art method of assembling a colour selecting mechanism suppresses somewhat occurrence of wrinkles by setting the interval b tween weld d points to prevent occurrence of wrinkles; how ver, it cannot positively reduce occurrence of wrinkles, which obstructs improvement in

quality. Such a disadvantage of the related art method includes an inconveni nce that a suitable interval between w lded points must be determined each time there is a change of a condition (thickness and/or slit pitch) in the case of manufacturing the aperture grilles 1 under special specifications.

An object of the present invention is to provide a method of assembling a colour selecting mechanism for a cathode-ray tube, which is capable of setting an optimum interval between welded points for preventing occurrence of torsion and strain, thereby stabilizing the quality of the colour selecting mechanism and easily setting the interval between welded points even when there is a change of a condition (thickness and/or slit pitch).

Another object of the present invention is to provide a colour selecting mechanism assembled by the above method.

To achieve the first object, according to a first aspect of the invention, there is provided a method of assembling a colour selecting mechanism for a cathode-ray tube, comprising the steps of:

preparing a grid structure formed of a square metal sheet having a plurality of slits extending in the direction perpendicular to a pair of parallel sides of said metal sheet;

pressing a frame having a pair of members in parallel to each other in the same direction as that of said parallel sides of said metal sheet in such a manner that said members are close to each other;

welding a pair of said parallel sides of said grid structure each to a pair of said members; and

releasing the pressure applied to said frame and mounting said grid structure on said frame in a stretching state;

wherein each of intervals "w" between welded points at which said grid structure is welded to said members is set to be in a range from 20 to 35 times a thickness "t" of said grid structure and from 8 to 14 times a pitch "p" of said slits.

To achieve the second object, according to a second aspect of the inventi n there is provided a colour selecting mechanism for a cathode-ray tube, c mprising:

a grid structure formed of a square metal sheet having a plurality of slits extending in the direction perpendicular to a pair of parallel sides of said metal sheet; and

a frame having a pair of members in parallel to each other in the same direction as that of said parallel sides of said metal sheet;

wherein said grid structure is installed to said frame by a pair of said parallel sides of said grid structure each to a pair of said members, said grid structure being mountable on said frame in a stretched state; and

each of intervals "w" between welded points at which said grid structure is welded to said members is set to be in a range from 20 to 35 times a thickness "t" of said grid structure and from 8 to 14 times a pitch "p" of said slits.

Each of the above intervals between welded points may be set to be in a range from 24 to 29 times a thickness of the grid structure and from 8 to 14 times a pitch of the slits; or in a range from 20 to 35 times a thickness of the grid structure and from 10 to 12 times a pitch of the slits. More preferably, each of the above intervals between welded points may be set to be in a range from 24 to 29 times a thickness of the grid structure and from 10 to 12 times a pitch of the slits.

In the present method of assembling a colour selecting mechanism for a cathode-ray tube and the colour selecting mechanism assembled by the method, each interval between welded points is set to be in the above specified range, and accordingly it is possible to ensure a degree of freedom for removing torsion and strain components around welded points and prevent a stress applied to each welded point from producing torsion and strain around the welded point, and hence to significantly reduce the occurrence rate of wrinkles ccurring in the grid structure. As a result, it is possible t stabilize the quality of th colour sel cting

mechanism and to easily set the interval between welded p ints even when there is a change of a condition (thickness and/or pitch).

The invention will be further described by way of non-limitative example with reference to the accompanying drawings, in which:-

Figure 1 is an illustrative view of intervals between welded points at which an aperture grille is welded to a frame in accordance with an assembling method of the present invention;

Figure 2 is a flow chart showing a procedure of assembling a colour selecting mechanism for a cathode-ray tube;

Figure 3 is a perspective view of a colour selecting mechanism; and

Figure 4 is an enlarged view showing an essential portion of an aperture grille.

Hereinafter, preferred embodiments of a method of assembling a colour selecting mechanism for a cathode-ray tube of the present invention will be described with reference to the drawings.

Figure 1 is an illustrative view of intervals between welded points at which an aperture grille is welded on a frame in accordance with the assembling method of th present invention, and Figure 2 is a flow chart showing a procedure for assembling a colour selecting mechanism for a cathode-ray tube. In addition, parts corresponding to those shown in Figures. 3 and 4 are indicated by the same characters, and the repeated explanation thereof is omitted.

As shown in Figures. 2 and 3, a colour selecting mechanism is assembled by the steps of cleaning a frame 7, mounting a spring holder 21 (see Figure 3) to the frame 7, pressing the frame 7 in such a manner that A members 9 to which the aperture grille 1 is to be welded are close to each oth r, and welding in such a state opposed sides of the aperture grill 1 each to the A members 9 by seam welding or laser welding.

Next, by releasing the pressure applied to the frame 7, the aperture grille 1 is mounted on the frame 7 in a

state being stretched at a high tension. A portion of the aperture grille 1 projecting from th frame 7 is then removed by trimming, and the aperture grille 1 and the fram 7 are blackened, followed by mounting of the spring 23 and the like.

In the inventive assembling method, the aperture grille 1 is welded to the A members 9 at specified intervals "w" between welded points (see Figure 1). More specifically, the interval "w" between welded points is set to be in a range of from 20t to 35t (t: thickness of aperture grille 1) and from 8p to 14p (p: pitch of slits 3). Such a range of the interval "w" between welded points is determined in consideration of the fact that torsion and strain of the aperture grille 1 produced after release of the pressure applied to the frame 1 are dependent on the interval between welded points and also the interval between welded points varies depending on the plate thickness "t" of the aperture grille 1 and the pitch "p" of the slits.

Table 1 shows results of a test of examining occurrence rate of wrinkles for 17 inch type aperture grilles 1 (condition: specified as described below) which are each welded to frames 7 at different intervals between welded points.

Condition:

thickness of aperture grille: 0.1 mm

slit pitch: 0.25 mm

Inspection of wrinkles: visual

As is seen from the results shown in Table 1, th occurrence rate of wrinkles is significantly higher when the interval between welded points is out of a range of from 2.0 mm to 3.5 mm. This shows that these values define the borderlines of the significantly increased occurrence rate of wrinkles, and accordingly, the range between these values, that is, from 2.0 mm to 3.5 mm has a critical characteristic in terms of occurrence rate of wrinkles.

Table 1

interval between welded points (centre to centre between welded points: mm)	occurrence rate f wrinkles (occurrence number of wrinkles/number of measurement)
1.8	11/20
1.9	9/20
2.0	1/20
2.2	0/20
2.4	0/20
2.6	0/20
2.8	0/20
3.0	0/20
3.2	1/20
3.4	1/20
3.5	1/20
3.6	8/20

The reason why the above range has the critical characteristic is as follows: namely, when the interval between welded points is less than 2.0 mm, a degree of freedom for removing torsion and strain around welded points is made smaller (in other words, a distance for absorbing strain is shortened); and when the interval between welded points is more than 3.5 mm, a stress applied to each welded point 25 is made larger, tending to produce torsion and strain of the tape portions 5 around the welded point.

With respect to the aperture grille 1, when the pressure applied to the frame 7 is released, wrinkles do not occur if the slit pitch is set at 0.5 mm; while they occur at a high occurrence rate if the slit pitch is set at 0.25 mm. Accordingly, the occurrence rate of wrinkles tends to be increas d as the slit pitch becomes smaller. Also, th occurrence rate of wrinkles tends to b increased as the thickness of the aperture grille 1 becomes thinner.

The range of the interval "w" between welded points can be convert d in relation to these values (slit pitch "p",

thickness "t") into a range of from 20 to 35 times of the thickness "t" and from 8 to 14 times the slit pitch "p". Namely, by setting the interval "w" b tween welded points in the range of from 20 to 35 times the thickness "t" and from 8 to 14 times the slit pitch "p", it is possible to obtain an effect of significantly reducing the occurrence of wrinkles, so-called, a peak effect in terms of occurrence of wrinkles.

Table 2 shows results of a test of examining the occurrence rate of wrinkles for aperture grilles (condition: specified as described below) which are each welded to frames at intervals "w" between welded points in a range of 2.0 to 3.5 mm, wherein the number of measurement is increased more than that in the previous test.

Condition:

thickness of aperture grille: 0.1 mm

slit pitch: 0.25 mm

Inspection for wrinkles: visual inspect

Table 2

interval between welded points (centre to centre between welded points: mm)	occurrence rate of wrinkles (number of occurrence of wrinkles/number of measurement)
2.1	1/100
2.2	1/100
2.3	1/100
2.4	0/100
2.8	0/100
2.9	0/100
3.0	1/100
3.1	1/100

As is seen from the r sults in Table 2, wrinkles do not occur when the interval between weld d points is in a range of from 2.4 mm to 2.9 mm. This shows that the range between these value, that is, from 2.4 mm to 2.9 mm has a

critical characteristic. As described above, the wrinkles occur in the aperture grille 1 depending on the slit pitch "p" and the thickn ss "t", so that the above range is converted in relation to these values into a range of from 24 to 29 times the thickness "t" and from 9.6 to 11.6 (10 to 12 by rounding the numerical value below 1.0) times the slit pitch "p". Namely, by setting the interval "w" between welded points in the range of from 24 to 29 times the thickness "t" and from 10 to 12 times the slit pitch "p", it is possible to obtain a significant effect of eliminating occurrence of wrinkles.

According to the above-described method of assembling a colour selecting mechanism for a cathode-ray tube, when the opposed sides of the aperture grille 1 are welded to the A members 9 of the frame by seam welding or laser welding while the frame 7 is pressed in such a manner that the A members 9 are closed to each other, the interval "w" between welded points is set to be in the range of from 20 to 35 times the thickness "t" and from 8 to 14 times the pitch "p", so that it is possible to significantly reduce th occurrence rate of wrinkles occurring in the aperture grille 1 after release of the pressure applied to the frame 7. Moreover, by setting the interval "w" between welded points in the range of from 24 to 29 times the thickness "t" and from 10 to 12 times the pitch "p", it is possible to perfectly prevent wrinkles from occurring in the aperture grille 1 after release of the pressure applied to the frame 7.

Additionally, according to the above-described m thod of assembling a colour selecting mechanism for a cathode-ray tube, since the interval "w" between welded points can be set in relation to the thickness "t" and th pitch "p", it is not required to determine the interval "w" between welded points each time there is a change of a condition (thickness and/or slit pitch) in the case of manufacturing the aperture grilles 1 under special specifications, that is, it is possible to easily set an optimum interval "w" between welded points for preventing occurrence of torsion and strain even when there is a change of the condition (thickness and/or slit pitch).

While the preferred embodiment of the present invention has been described, such description is for illustrative purposes only, and it is to be understood that changes and variations may be made without departing from the spirit or scope of the following claims.

CLAIMS

1. A method of assembling a colour selecting mechanism for a cathode-ray tube, comprising the steps of:

preparing a grid structure formed of a square metal sheet having a plurality of slits extending in the direction perpendicular to a pair of parallel sides of said metal sheet;

pressing a frame having a pair of members in parallel to each other in the same direction as that of said parallel sides of said metal sheet in such a manner that said members are close to each other;

welding a pair of said parallel sides of said grid structure each to a pair of said members; and

releasing the pressure applied to said frame and mounting said grid structure on said frame in a stretching state;

wherein each of intervals "w" between welded points at which said grid structure is welded to said members is set to be in a range from 20 to 35 times a thickness "t" of said grid structure and from 8 to 14 times a pitch "p" of said slits.

2. A method of assembling a colour selecting mechanism for a cathode-ray tube according to claim 1, wherein each of said intervals "w" between welded points is set to be in a range from 24 to 29 times a thickness "t" of said grid structure and from 8 to 14 times a pitch "p" of said slits 3.

3. A method of assembling a colour selecting mechanism for a cathode-ray tube according to claim 1, wherein each of said intervals "w" between welded points is set to be in a range from 20 to 35 times a thickness "t" of said grid structure and from 10 to 12 times a pitch "p" of said slits.

4. A method of assembling a colour selecting mechanism for a cathode-ray tube according to claim 1, wherein each of said intervals "w" between welded points is set to be in a range from 24 to 29 times a thickness "t" of said grid structure and from 10 to 12 times a pitch "p" of said slits.

5. A colour selecting mechanism for a cathode-ray tube, comprising:

a grid structure formed of a square metal sheet having a plurality of slits extending in the direction perpendicular to a pair of parallel sides of said metal sheet; and

a frame having a pair of members in parallel to each other in the same direction as that of said parallel sides of said metal sheet;

wherein said grid structure is installed to said frame by a pair of said parallel sides of said grid structure each to a pair of said members, said grid structure being mountable on said frame in a stretched state; and

each f intervals "w" between welded points at which said grid structure is w lded to said members is set to be in a range from 20 t 35 times a thickness "t" of said

grid structur and from 8 to 14 times a pitch "p" of said slits.

6. A colour selecting mechanism for a cathode-ray tube according to claim 5 in which the grid structure has been installed to said frame by pressing said frame in such a manner that said members are close to each other, welding said pair of said parallel sides of said grid structure each to a pair of said members and releasing the pressure applied to said frame and mounting said grid structure on said frame in a stretched state.

7. A colour selecting mechanism for a cathode-ray tube according to claim 5 or 6, wherein each of said intervals "w" between welded points is set to be in a range from 24 to 29 times a thickness "t" of said grid structure and from 8 to 14 times a pitch "p" of said slits.

8. A colour selecting mechanism for a cathode-ray tube according to claim 5 or 6, wherein each of said intervals "w" between welded points is set to be in a range from 20 to 35 times a thickness "t" of said grid structure and from 10 to 12 times a pitch "p" of said slits.

9. A colour selecting mechanism for a cathode-ray tube according to claim 5 or 6, wherein each of said intervals "w" between welded points is set to be in a range from 24 to 29 times a thickness "t" of said grid structure and from 10 to 12 times a pitch "p" of said slits.

10. A method for constructing a colour selecting mechanism for a cathode-ray tube substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings

11. A colour selecting mechanism for a cathode-ray tube constructed and arranged to operate substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings

12. A cathode ray tube incorporating a mechanism according to any one of claim 5 to 9 or 11.

The Patent Office

15

Application No: GB 9625508.8 **Examiner:** Martyn Dixon
Claims searched: all **Date of search:** 19 December 1996

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): H1D (DAD3,DAF4,DATX); B3A (A75)

Int Cl (Ed.6): H01J (9/14,29/07)

Other: online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
A	US 4828523 A	(Zenith) see col 9, lines 48-56	1,5
A	US 4806820 A	(Alcatel) see col 2, lines 57-67	1,5

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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